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CONNECTICUT RIVER BASIN DURHAM , CONNECTICUT



YMCA POND DAM CT 00385

PHASE I INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEER
WALTHAM, MASS. 02154

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Connecticut River Basin Durham, Connecticut

20. ABSTRACT ("entitue on reverse side if necessary and identify by black number)

YMCA Pond is a concrete gravity dam 80 feet in length and 26 feet in height. The pond has a storage volume of 35 acre-feet and a maximum height of 26 feet; the size classification is thus "small". The dam has been classified as having a "significant" hazard potential. Based on the visual inspection, the YMCA Pond Dam appears to be in fair condition. For the combination of dam size (small) and downstream hazard (significant), a range in the magnitude of the spillway test flood of the 100 year frequency to the $\frac{1}{2}$ PMF is given.



DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION. CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM MASSACHUSETTS 02154

SEP : 1

Honorable Ella T. Grasso Governor of the State of Connecticut State Capitol Hartford, Connecticut 06115

Dear Governor Grasso:

Inclosed is a copy of the YMCA Pond Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, Farnam Neighborhood House, 162 Fillmore Street, New Haven, Connecticut 96513.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

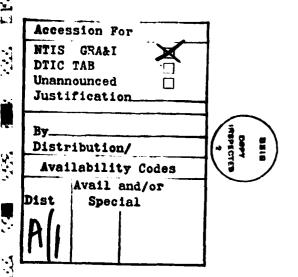
Sincerely,

Incl
As stated

MAX B. SCHEIDER

Colonel, Corps of Engineers

Division Engineer



YMCA POND DAM
CT 00385

CONNECTICUT RIVER BASIN
DURHAM, CONNECTICUT



PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

DISTRIBUTION STATEMENT A

Approved for public release; Distribution Unlimited

NATIONAL DAM INSPECTION PROGRAM PHASE I INSPECTION REPORT

Identification No.:

Name of Dam:

County and State:

Stream:

Town:

Z

Date of Inspection:

CT 00385

YMCA Pond Dam

Durham

Middlesex, Connecticut Tributary To Hersig Brook

6 November, 1979

BRIEF ASSESSMENT

YMCA Pond is a concrete gravity dam 80 feet in length and 26 feet in height. The upstream face of the dam is vertical. The downstream face of the dam slopes at 1 H to 3 V. A concrete abutment wall 20 feet in length extends from the dam along the edge of the pond at the left abutment. The spillway comprises the central portion of the gravity dam and is 23 feet long. The downstream face of the spillway is curvilinear. Wooden flash-boards are in place at the spillway, level with the top elevation of the dam.

The purpose of the dam is to impound the YMCA pond for recreational use. The pond has a storage volume of 35 acre-feet and a maximum height of 26 feet; the size classification is thus "small." Approximately two residential homes would be subject to flooding to a depth of about 3 feet above the first floor elevation due to a dam failure. With the loss of life potential estimated to be few, since no more than a small number of inhabitable structures are located in the probable dam failure impact area, the dam has been classified as having a "significant" hazard potential.

Based on the visual inspection, the YMCA Pond Dam appears to be in fair condition. Water was overflowing the spillway at the time of inspection. Some cracking, spalling and efflorecence of concrete surfaces was observed. The vertical and horizontal alignment of the dam was good. Some erosion of weathered rock at the abutments was noted. Seepage was observed at the right abutment.

For the combination of dam size (small) and downstream hazard

(significant), a range in the magnitude of the spillway test flood of the 100 year frequency to the 1/2 PMF is given. A spillway test flood of the 100 Year Frequency Flood was selected for the project. The maximum spillway capacity without overtopping the dam is 340 CFS (without flashboards.) The capacity of the spillway is inadequate to pass the test flood outflow of 470 CFS without overtopping the dam. The test flood would overtop the dam by 0.3 feet. The spillway is adequate to pass 75 percent of the spillway test flood outflow without overtopping the dam.

Within one year of receipt of the Phase I Inspection Report, the owner should retain a qualified registered engineer to:

1) Investigate the erosion and seepage occurring on the downstream portion of the rock abutments and design corrective measures, if needed, 2) Conduct more refined hydrologic and hydraulic analysis to determine the need for and methods of increasing the project discharge capacity and 3) raise footbridge to prevent collection of debris and restriction of flow. The owner should carry out the recommendations of the engineer.

The owner should also carry out the following operational and maintenance procedures: 1) Determine the operability of the outlet works and repair as required. A program of regular valve maintenance should be implemented. 2) Institute a program of annual technical inspections of the dam and its appurtenances by a qualified registered engineer. 3) Repair all spalled and deteriorated concrete on the downstream face of the dam. 4) Establish a surveillance and flood warning plan during and immediately after heavy rainfall, and also a warning program to follow in case of emergency conditions.

fliavara S. Giavara, P.E.

President

Registered CT 7634

YMCA POND DAM This Phase I Inspection Report on has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

RICHARD DIBUONO, MEMBER Water Control Branch Engineering Division

ARAMAST MAHTESIAN, MEMBER Geotechnical Engineering Branch Engineering Division

CARNEY M. TERZIAN, CHAIRMAN Design Branch Engineering Division

APPROVAL RECOMMENDED:

Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation: however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Investigation does <u>not</u> include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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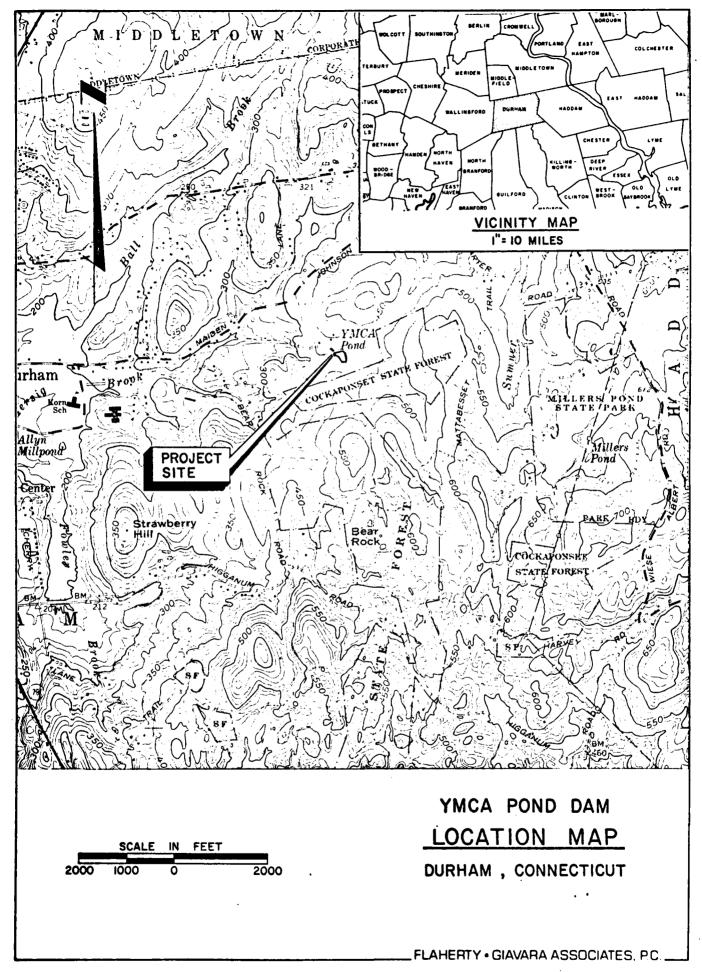
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OVERVIEW PHOTO YMCA Pond Dam



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NATIONAL DAM INSPECTION PROGRAM PHASE I INSPECTION REPORT YMCA POND DAM - CT 00385

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL:

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection through the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Flaherty Giavara Associates, P.C. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to Flaherty Giavara Associates, P.C. under a letter of 19 October 1979 from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-80-C-0001 has been assigned by the Corps of Engineers for this work.

b. Purpose.

- 1) Perform technical inspection and evaluation of non-federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-federal interests.
- 2) Encourage and assist the States to initiate quickly effective dam safety programs for non-federal dams.
- 3) To update, verify and complete the National Inventory of Dams.

1.2 DESCRIPTION OF THE PROJECT:

- a. Location. YMCA Pond Dam is located in Durham, Connecticut approximately one mile east of Durham Center. Access to the dam is from an unimproved road (2000± feet) off Maiden Lane. The reservoir is shown on the U.S.G.S. Topographic map "Durham, Connecticut" at a latitude of 41° 28' 40'' and a longitude of 72° 39' 10''. The Location Map on page vi shows the location of the dam.
- b. Description of Dam and Appurtenances. YMCA Pond is a concrete gravity dam 80 feet in length and 26 feet in height. The upstream face of the dam is vertical. The downstream face of the dam slopes at 1 H to 3 V. The abutments of the dam consist of ledge rock. A concrete abutment wall 20 feet in length extends from the dam along the edge of the pond at the left abutment. The dam crest elevation is El. 350 (NGVD). A 10 foot section of the

dam near the left abutment is at El. 351 (NGVD).

The spillway comprises the central portion of the gravity dam and is 23 feet in length. The downstream face of the spillway is curvilinear but is approximately 1 H to 3 V. Wooden flash-boards are in place at the spillway (El. 350), level with the top elevation of the dam. The spillway discharge channel is approximately 10 feet wide, consisting of a cobble and gravel bottom, with wooded banks.

The outlet works consist of a 12 inch dia. cast iron pipe which passes through the base of the concrete gravity dam to the right of the central spillway section. A hand-operated valve is located on the outlet pipe at the downstream face of the dam. The valve has not been operated in several years. The invert elevation of the outlet pipe is approximately at El. 330 NGVD.

- c. Size Classification. YMCA Pond Dam has a storage volume of 35 acre-feet and a maximum height of 26 feet. A dam height of greater than 25 feet but less than 40 feet classifies this structure in the "small" category according to guidelines established by the Corps of Engineers.
- d. Hazard Classification. The dam is classified as having a "significant" hazard potential. Approximately two residential homes would be subject to flooding to a depth of about 3 feet above the first floor elevation due to a dam failure. With the loss of life potential estimated to be few, since no more than a small number of inhabitable structures are located in the probable dam failure impact area, the dam has been classified as having a "significant" hazard potential. A school is located about 1 mile downstream of the dam, but would not be flooded due to dam failure.
- e. Ownership. The dam is owned by the Farnam Neighborhood House, 162 Fillmore Street, New Haven, Connecticut, 06513. Phone: 203-562-9194.
- f. Operator. There is no formal operator for this dam. The present Executive Director of the Farnam Neighborhood House is Mr. J. Furuno, Phone: 203-562-9194.
- g. Purpose of Dam. The present purpose of the pond is for recreational activity for attendees of a summer camp owned and operated by the Farnam Neighborhood House. The original purpose of the dam is unknown.
- h. Design and Construction History. There is no design or construction information available for this dam.
- i. Normal Operation Procedure. The water level is maintained principally by the spillway crest elevation. A 12 inch

dia. blow-off passes through the dam structure.

1.3 PERTINENT DATA:

a. Drainage Area. The drainage area is 0.4 square miles of wooded upland terrain. The pond has a single unnamed tributary which begins to the south in a wetland area and flows north collecting runoff from the adjacent hillside. The drainage area is totally undeveloped and approximately 40 percent of the area is state-owned forest (Cockaponset State Forest).

b. Discharge at Dam Site.

- 1) The outlet works consist of a manually operated valve-box located on the downstream end of a 12 inch dia. cast iron pipe which passes through the dam. The discharge capacity of the 12 inch cast iron pipe (El. 330± NGVD), with a pond level of El. 350± is estimated to be 20 CFS.
- 2) There are no known records of past floods or flood stage heights at the dam.
- 3) The ungated (without flashboards) spillway capacity at the top of dam 341 CFS @ El. 351.
- 4) The ungated spillway capacity at the test flood elevation 460 CFS @ El. 351.3.
- 5) The gated (flashboards in place) spillway capacity at normal pool elevation 70 CFS @ El. 350.
- 6) The gated spillway capacity at test flood elevation 434 CFS @ El. 351.6.
- 7) The total spillway capacity at test flood elevation 434 CFS @ El. 351.6.
- 8) The total project discharge at the top of dam 214 CFS @ El. 351 (flashboards in place) and 341 CFS @ El. 351 (without flashboards).
- 9) The total project discharge at test flood elevation 450 CFS @ El. 351.6 (flashboards in place) and 467 CFS @ El. 351.3 (without flashboards).

c. Elevation. (Feet above NGVD)

- 1) Streambed at toe of dam......325±
- 3) Maximum tailwater......327±

		7)	Design surchar	350-with flashboard ge (Original Design)Unkn
333 34		8)	Top of dam	
3		9)	Test flood des	sign surchage351.5 with flashbo
S S	đ.	Res	servoir. (Lengt	th in feet)
S.		1)	Normal pool	
255		2)	Flood control	pool
∽		3)	Spillway crest	pool3
		4)	Top of dam	
*		5)	Test flood poo	
	e.	Sto	orage (acre-feet	=)
Ĺ		1)	Normal pool	
, w		2)	Flood control	pool
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		2)	Flood control	pool
3		3)	Spillway crest	
		4)	Test flood poo	01
		5)	Top of dam	
	g.	Dam	•	
رَّ ا		1)	Type:	. Concrete gravity
\$		2)	Length:	80 feet
रहा				- 4 -

Height: 26 feet 3) Top Width: 4) 1 feet 5) Side Slopes: U/S vertical; D/S 1 horizontal to 3 vertical Zoning: 6) N/A 7) Impervious Core N/A Cut-off: 8) Unknown 9) Grout Curtain: Unknown Diversion and Regulating Tunnel. N/A 1) Type: 2) Length: N/A Closure: N/A 3) 4) Access: N/A Regulating Facilities: 5) N/A Spillway. i. 1) Type: Concrete gravity 2) Length of Weir: 23 feet 3) Crest Elevation: Without flashboard - 349 With flashboard - 350 4) Gates: Wooden flashboard U/S Channel: 5) Reservoir D/S Channel: 6) Natural stream channel, 10 feet wide, wooded side slope, gravel and cobble bed. j. Regulating Outlets. Invert: 1) 330± 2) Size: 12 inch diameter Description: Cast iron pipe 3) Control Mechanism: Manually operated valve box

SECTION 2 - ENGINEERING DATA

2.1 DESIGN:

No engineering data has been found to provide any information about the design of YMCA Pond Dam.

2.2 CONSTRUCTION:

No information relative to the construction of the dam is available. Information presented in this report was primarily obtained by interviews and direct field measurements of the existing dam.

2.3 OPERATION:

Formal operation records are not available for this dam.

2.4 EVALUATION:

- a. Availability. There are no plans, specifications or computations available from the owner or State regarding the design, construction or subsequent repairs and modifications to this dam.
- b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of the dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on the visual inspection, the dam's past performance, and sound engineering judgment.
- c. Validity. There is no reason to question the validity of the available data.

3.1 FINDINGS:

a. General. Based on the visual inspection, the YMCA Pond Dam appears to be in fair condition. The dam is a concrete gravity structure with base and abutments founded in bedrock. The central portion of the structure is stepped down to form a partial crest spillway. Water was overflowing the spillway at the time of inspection. Some cracking, spalling and efflorecence of concrete surfaces was observed. The vertical and horizontal alignment of the dam was good. Some erosion of weathered rock at the abutments was observed. Seepage was noted at the right abutment.

b. Dam.

- 1) Upstream Face The upstream face of the dam was below the reservoir level and not visible at the time of the inspection. (See Photo No. 3)
- 2) Crest A wooden footbridge spans the crest of the dam, as shown in Photo No. 2 and Photo No. 3.
- 3) Downstream Face and Abutments The downstream face of the dam is shown in Photo 4 and the downstream portions of the abutments are shown in Photos No. 1, No. 4, No. 5 and No. 8.

Portions of the rock abutments have been concreted at the contact between the abutments and the downstream face of the dam, as shown in Photo No. 6 and No. 7. Several metal pipes are cast into the concreted areas of the abutments. (See Photo No. 9) Two 1-in.-diameter pipes, one plugged and one discharging a small amount of water, are located in the left abutment adjacent to the downstream face about 5 ft below the crest. Another 1-in-diameter pipe, plugged with wood, is located adjacent to the downstream face about 5 ft below the crest in the right abutment. A 1-in.-diameter pipe plugged with cement and two 2-in.-diameter pipes plugged with wood are located in the right abutment about 10 ft downstream from the face of the dam at about mid-slope. The function of these pipes is not known.

Weathering and erosion of the rock abutments was observed in several locations. (Photo No. 6 and No. 7) The weathered rock has eroded back about 2-3 ft in an area adjacent to the downstream face at the left abutment, as shown in Photo No. 7. Photo No. 10 shows an example of erosion that has occurred at the downstream edge of the concreted area on the right abutment. The conglomerate bedrock is weathered to gravel in a clayey matrix at these and other locations.

Seepage was observed exiting from the rock on the right abutment at about midslope approximately 12 ft downstream from the face

of the dam at the downstream edge of the concreted portion of the abutment. (Photo No. 11) A smaller seep was observed farther upslope along the rock/concrete contact. It was not possible to determine whether seepage was occurring through the rock at the base of the dam because of the water discharging over the spillway.

- 4) Spillway The spillway is located within the central portion of the concrete gravity dam. (Photo No. 1) The concrete forming the spillway section is in fair condition evidenced by concrete erosion and spalling on the downstream face. (Photo No. 8) Wood flashboards are in place within the spillway section (1' high by 2" wide). The flashboards are in good condition.
- c. Appurtenant Structures. The outlet works consist of a 12 inch diameter cast iron pipe which passes through the concrete gravity dam. A control valve with valve stem is located at the base of the dam on the downstream side. (See Photo No. 10) The outlet works were not operated during the field review nor have they been operated in several years as reported by the owner. The visible portions of the valve housing and outlet pipe were rusted. The condition of the outlet works passing through the dam is unknown.
- d. Reservoir Area. The perimeter of the pond is moderate to steep sloping and wooded. A small beach area is located along the north side of the pond. There was no evidence of slides or slope failures. No sediment deposits were observed above the water level of the reservoir.
- e. Downstream Channel. The channel is a natural stream 10 ft.in width with steep sloping banks. (Photo No. 12) The stream bed is lined with cobbles and gravel with wooded banks.
- f. Footbridge. A wood footbridge spans the crest of the dam as shown in Photos No. 2 and No. 3. The footbridge is supported by wood blocks attached to the concrete crest by metal angle sections. There is one foot clearance from the crest of the dam to the bottom of the footbridge. The footbridge is in fair condition. Most wooden members of the structure are sound with the exception of several wood supports near the right abutment.

3.2 EVALUATION:

Based on the visual inspection, the dam appears to be in fair condition. However, the erosion and seepage observed on the downstream portion of the rock abutments cannot be fully evaluated by visual inspection and warrants further investigation.

Also the outlet works should be restored to an operable condition and the valve should be exercised regularly.

The footbridge causes a potential for collecting debris and restricting flow. Consideration should be given to raising the bridge to provide adequate clearance over the crest of the dam.

SECTION 4 - OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 OPERATIONAL PROCEDURES:

- a. General. The dam is equipped with a method of lowering the water level by opening a control valvue that operates a 12 inch dia. outlet pipe.
- b. Description of any Warning System in Effect. There is no warning system of any kind in effect at the dam.

4.2 MAINTENANCE PROCEDURES:

- a. General. Maintenance of the dam appears to be generally lacking.
- b. Operating Facilities. There are no operating facilities at the dam.

4.3 EVALUATION:

Regular operational maintenance for this dam and its appurtenances has not been developed or implemented.

An emergency action plan should be prepared to prevent or minimize the impact of failure. This plan should list the expedient action to be taken and authorities to be contacted.

5.1 GENERAL DATA:

The YMCA Pond Dam is a concrete gravity structure with a crest length of 80 Feet and a height of 26 feet. The spillway is centrally located and is 23 feet in length (El. 349 NGVD). flashboards are presently in place at the spillway (1 foot high by 23 feet wile) to an elevation equal to the crest of the dam (E1. 350). With flashboards in place, the entire width of the gravity dam functions as the spillway section. Located near the left abutment is a 10 foot section of the dam one foot higher (E1. 351) than the crest of the dam. The approach to the spillway is directly from the reservoir. The depth of the reservoir at the face of the dam is approximately 10 feet. The downstream face of the dam section slopes at approximately 1 H to 3 V. downstream fage of the spillway (23 feet wide) is curvilinear but approximates [H to 3 V.

The outlet works consist of a 12 inch cast iron pipe which passes through the concrete gravity dam. The outlet works are only visible at the base of the dam on the downstream side near the right abutment. A manual valve is located at this location on the outlet works pipe. The invert elevation of the outlet pipe is approximately El. 330 NGVD. The watershed area of the dam is 0.4 square miles of wooded upland terrain. The pond has a single unnamed tributary which begins to the south in a wetland area U.4 Square miles of wood unnamed tribulary which and flows north collection the watershed is totally of the area is state-own Future development within minimal because of state

5.2 DESIGN DATA:

There is no design data existing design informat = 2000') were used to de hydraulic design data was at the time of field ins

5.3 EXPERIENCE DATA:

There is no known experiing the test flood for deter corps of Engineers guide and flows north collecting runoff from the adjacent hillside. The watershed is totally undeveloped and approximately 40 percent of the area is state-owned forest land (Cockaponset State Forest). Future development within the watershed is anticipated to be minimal because of state-ownership combined with limited access.

There is no design data available for this dam. In lieu of existing design information, U.S.G.S. Topographic Maps (scale 1" = 2000)') were used to develop hydrologic parameters. Pertinent hydraulic design data was obtained by actual field measurements at the time of field inspection.

There is no known experience data available for this dam.

TEST FLOUD ANALYSIS:

The test flood for determining the spillway adequacy is based on Corps of Engineers guidelines. The size of the dam is "small"

based on a storage volume of 35 acre feet and a dam height of The hazard classification is determined to be 26 feet. "significant". Loss of life is anticipated to be few should the dam fail. Two homes would experience flood waters to a depth of about 3 feet above the first floor elevation. Korn School located approximately one mile downstream of the dam would not be flooded due to a dam failure. Corps of Engineers guidelines for a "small" dam with "significant" hazard gives a range for the selection of the test $\bar{f}lood$ from 100 year frequency to 1/2The probable maximum flood (PMF) is that flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are possible for the region. The test flood selected for this dam is the 100 year frequency flood (1/4 PMF) based on consideration of the dam's low height and small storage volume.

The magnitude of the test flood was determined using methods developed by the Soils Conservation Service as described in "Design of Small Dams" by the Bureau of Reclamation. A triangular hydrograph was developed based on a test flood flow of 450 CFS and a 20-inch runoff volume.

The developed hydrograph was routed through the reservoir using a computer program based on stage-storage and stage-discharge data. The pond was assumed to be full and level with the spillway crest (flashboards in place) prior to the storm event. An effective length of spillway was utilized to compensate for the footbridge pier obstructions. In addition, it was assumed that the outlet conduit was closed throughout the test flood duration.

The test flood hydrograph routed through the reservoir resulted in a maximum pond level of 351.6 feet NGVD corresponding to a peak outflow rate of 450 CFS. The maximum depth of flow at the spillway section is 1.6 feet. The 10 foot section of the dam near the left abutment would be overtopped by 0.6 feet. All spillway discharges would be confined to the concrete gravity dam section. Assuming the flashboards are removed, the maximum reservoir stage is 351.3 feet NGVD a 0.3 feet reduction.

The spillway capacity without overtopping the 10 foot section near the left abutment is 214 CFS, which is about 52 percent of the test flood outflow. The spillway capacity would be 340 CFS if the flashboards were to be removed which is about 85 percent of the test flood outflow. This spillway inadequacy is not judged to be serious because all flow overtops the concrete gravity dam section.

5.5 DAM FAILURE ANALYSIS:

The downstream impact of dam failure was analysed using a computer program developed based upon the Corps of Engineers "Rule of Thumb Guidance for Estimating Dam Failure Hydrographs" dated April 1978 as used in the National Dam Inspection Program.

The peak outflow rate is calculated by combining the dam failure outflow and the pre-failure discharge. Water surface elevations are calculated for both the pre-failure and post-failure conditions at selected stations downstream of the dam. The output data (see Appendix D) is used to define flood prone areas and select the hazard classification of the dam.

Based on an assumed breach width equal to 40 percent cf the dam's length at mid-height, the total peak outflow due to a flood wave would be 7400 CFS. This includes a flow in the downstream watercourse of 230 CFS equivalent to the maximum spillway discharge at the dam.

Approximately two residential homes would be subject to flooding to a depth of 3 feet above the first floor elevation due to a dam failure. The homes are located off Maiden Lane approximately 3,000 feet downstream of the dam. The maximum depth of flow at this location prior to and after dam failure would be 2 feet and 5 feet respectively. Korn School located approximately one mile downstream of the dam would not be flooded as the result of a dam failure. The relationship of computed elevations and stationing to flood prone properties is shown on sheet D-8, Appendix D.

It is anticipated that loss of life due to a dam failure would be few and economic loss would be appreciable. The hazard classificiation is therefore "significant."

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SECTION 6 - EVALUATION OF STRUCTURAL STABILITY

6.1 VISUAL OBSERVATIONS:

The visual inspection did not disclose any immediate stability problems. However, the erosion and seepage on the downstream portion of the rock abutments could affect the future stability of the dam.

6.2 DESIGN AND CONSTRUCTION DATA:

No original design and construction data are available. Thus, the assessment of stability is based only on the visual inspection.

6.3 POST-CONSTRUCTION CHANGES:

No records are available relative to post-construction changes. The service bridge was constructed after the original construction of the dam but does not effect dam stability.

6.4 SEISMIC STABILITY:

YMCA Pond Dam is located in Seismic Zone 1 and, in accordance with the recommended Phase I inspection guidelines, does not warrant seismic stability analysis.

7.1 DAM ASSESSMENT:

- a. Condition. Based on visual inspection, the dam appears to be in fair condition. However, the erosion and seepage on the downstream portion of the rock abutments warrant additional investigation as recommended in Section 7.2.
- b. Adequacy of Information. The information available is such that the assessment of safety is based solely on the visual inspection, past operational performance of the structure and sound engineering judgement.
- c. Urgency. The recommendations and remedial measures presented below should be implemented by the owner within two years after receipt of this Phase I inspection report.

7.2 RECOMMENDATIONS:

The owner should retain a qualified registered engineer to:

- a. Investigate the erosion and seepage occurring on the downstream portion of the rock abutments and design corrective measures, if needed.
- b. Conduct more refined hydrologic and hydraulic analysis to determine the need for and methods of increasing the project discharge capacity.
- c. Raise footbridge to prevent collection of debris and restriction of flow.

The owner should carry out the recommendations of the engineer.

7.3 REMEDIAL MEASURES:

- a. Operating and Maintenance Procedures. The owner should:
- 1. Determine the operability of the outlet works and repair as required. A program of regular valve maintenance should be implemented.
- 2. Institute a program of annual technical inspections of the dam and its appurtenances by a qualified registered engineer.
- 3. Repair all spalled and deteriorated concrete on the downstream face of the dam.

4. Establish a surveillance and flood warning plan during and immediately after heavy rainfall, and also a warning program to follow in case of emergency conditions.

7.4 ALTERNATIVES:

There are no practical alternatives to the recommendations contained in Sections 7.2 and 7.3.

APPENDIX A

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INSPECTION CHECK LIST

INSPECTION CHECK LIST

PARTY ORGANIZATION

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PROJECT YMCA Pond Dam	DATE November 6, 1979
	TIME1100
	WEATHER 50° F - Overcast
	W.S. ELEV U.SDN.
PARTY:	
1. R. Smith, FGA, Project Manager	
2. P. Burgess, FGA, Hydraulics/Hydro	logy
3. R. Murdock, GEI, Geotechnical	
4. D. Shields, GEI, Geotechnical	
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PROJECT FEATURE	INSPECTED BY REMARK
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PERIODIC INSPECTION CHECK LIST NATIONAL DAM INSPECTION PROGRAM

DAM: YMCA Pond Dam

DATE: Nov. 6, 1979

DAM: YMCA Pond Dam	DATE: NOV. 6, 1979		
AREA EVALUATED	CONDITIONS		
DAM EMBANKMENT	Concrete dam with abutments in rock - no earth embankment.		
Crest Elevation .	351.0 NGVD		
Current Pool Elevation	349.1 NGVD		
Maximum Impoundment to Date	Unknown.		
Surface Cracks	Some cracking and spalling of concrete on downstream face.		
Pavement Condition	N/A.		
Movement or Settlement of Crest	None observed.		
Lateral Movement	None observed		
Vertical Alignment	No misalignment observed.		
Horizontal Alignment	No misalignment observed.		
Condition at Abutment and at Concrete Structures	Some erosion of weathered rock at abutments. Seepage at right abutment.		
Indications of Movement of Structural Items on Slopes	N/A.		
Trespassing on Slopes	N/A.		
Sloughing or Erosion of Slopes or Abutments	Some erosion of weathered rock at abutments.		
Rock Slope Protection - Riprap Failures	N/A.		
Unusual Movement or Cracking at or near Toes	None observed.		
Unusual Embankment or Downstream Seepage	Seepage through joints in rock at right abutment.		
Piping or Boils	N/A.		
Foundation Drainage Features	Possible drain pipes part-way up slope at abutments - all pipes plugged except one at right abutment which was discharging.		
Toe Drains	None.		
Instrumentation System	None.		
Vegetation	N/A.		

PERIODIC INSPECTION CHECK LIST NATIONAL DAM INSPECTION PROGRAM

DAM: YMCA Pond Dam

DATE: Nov. 6, 1979

AREA EVALUATED	CONDITIONS
DIKE EMBANKMENT	
Crest Elevation	Not applicable
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	
Pavement Condition	
Movement or Settlement of Crest	
Lateral Movement	
Vertical Alignment	
Horizontal Alignment	
Condition at Abutment and at Concrete Structures	
Indications of Movement of Structural Items on Slopes	
Trespassing on Slopes	
Sloughing or Erosion of Slopes or Abutments	
Rock Slope Protection - Riprap Failures	
Unusual Movement or Cracking at or near Toes	
Unusual Embankment or Downstream Seepage	
Piping or Boils	
Foundation Drainage Features	
Toe Drains	
Instrumentation System	
Vegetation	_

PERIODIC INSPECTION CHECK LIST NATIONAL DAM INSPECTION PROGRAM

DAM: YMCA Pond Dam	DATE: Nov. 6, 1979		
AREA EVALUATED	CONDITIONS		
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE a. Approach Channel	Not applicable		
Slope Conditions			
Bottom Conditions			
Rock Slides or Falls			
Log Boom			
Debris			
Condition of Concrete Lining			
Drains or Weep Holes			
b. Intake Structure			
Condition of Concrete			
Stop Logs and Slots			

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DAM: YMCA Pond Dam

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DATE: Nov. 6, 1979

DAM: THER FORG Ball DATE: NOV. 6, 1979				
AREA EVALUATED	CONDITIONS			
OUTLET WORKS - CONTROL TOWER				
a. Concrete and Structural				
General Condition	Not applicable			
Condition of Joints	,			
Spalling				
Visible Reinforcing				
Rusting or Staining of Concrete				
Any Seepage or Efflorescence	•			
Joint Alignment	•			
Unusual Seepage or Leaks in Gate Chamber	v			
Cracks				
Rusting or Corrosion of Steel				
b. Mechanical and Electrical				
Air Vents				
Float Wells				
Crane Hoist	·			
Elevator				
Hydraulic System				
Service Gates				
Emergency Gates				
Lightning Protection System				
Emergency Power System				
Wiring and Lighting System in Gate Chamber				

DAM: YMCA Pond Dam

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DATE: Nov. 6, 1979

DAM 1 THEA TOTAL BALL	DATE: NOT 07 1313
AREA EVALUATED	CONDITIONS
OUTLET WORKS - TRANSITION AND CONDUIT General Condition of Concrete Rust or Staining on Concrete Spalling Erosion or Cavitation	None
Cracking Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

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DAM: YMCA Pond Dam	DATE: Nov. 6, 1979
AREA EVALUATED	CONDITIONS
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	Water flowing over spillway section during time of inspection. Condition of non-overflow section concrete was fair.
Rust or Staining	
Spalling	Some minor spalling of concrete.
Erosion or Cavitation	Erosion of concrete surface.
Visible Reinforcing	None observed.
Any Seepage or Efflorescence	None observed.
Condition at Joints	Some erosion noted.
Drain Holes	N/A
Channel	Natural stream bed
Loose Rock or Trees Overhanging Channel	Not significant.
Condition of Discharge Channel	Not significant.
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DAM: YMCA Pond Dam

DATE: Nov. 6, 1979

DAM : THEA TOTA DAM	DATE: Nov. 6, 2373		
AREA EVALUATED	CONDITIONS		
OUTLET WORKS - SPILLWAY WEIR APPROACH AND DISCHARGE CHANNELS	Partial crest spillway discharge into down- stream channel which is a natural river bed.		
a. Approach Channel	Underwater.		
General Condition	,		
Loose Rock Overhanging Channel			
Trees Overhanging Channel			
Floor of Approach Channel			
b. Weir and Training Walls			
General Condition of Concrete	Some minor spalling and erosion of concrete noted.		
Rust or Staining	None observed.		
Spalling	Some spalling noted.		
Any Visible Reinforcing	None.		
Any Seepage or Efflorescence	Some efflorescence noted.		
Drain Holes	Drain pipes in right abutment area.		
c. Discharge Channel			
General Condition	Good		
Loose Rock Overhanging Channel	Not significant.		
Trees Overhanging Channel	Not significant.		
Floor of Channel	Natural river bed, few boulders.		
Other Obstructions	None.		

INSPECTION PERIODIC CHECK LIST NATIONAL DAM INSPECTION PROGRAM

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DAM: YMCA Pond Dam	DATE: Nov. 6, 1979	
AREA EVALUATED	CONDITIONS	
OUTLET WORKS - SERVICE BRIDGE	Timber footbridge, recently constructed, in good condition.	
a. Superstructure		
Bearings		
Anchor Bolts		
Bridge Seat		
Longitudinal Members	·	
Under Side of Deck		
Secondary Bracing		
Deck		
Drainage System		
Railings		
Expansion Joints		
Paint		
b. Abutment & Piers		
General Condition of Concrete		
Alignment of Abutment		
Approach to Bridge		
Condition of Seat and Backwall		

APPENDIX B

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ENGINEERING DATA

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DESIGN, CONSTRUCTION, OPERATION ENGINEERING DATA CHECK LIST PHASE I

NAME OF DAM YMCA Pond Dam

CT-00385

I.D. NO.

Available from U.S.G.S. REMARKS Field Measurements Field Measurements Field Measurements None Available None Available Unavailable Unknown None None None None - Discharge Ratings RAINFALL/RESERVOIR RECORDS TYPICAL SECTIONS OF DAM REGIONAL VICINITY MAP Constraints CONSTRUCTION HISTORY DESIGN COMPUTATIONS - Details AS-BUILT DRAWINGS GEOLOGY REPORTS - Plan DESIGN REPORTS OUTLETS

None None

None None

MATERIALS INVESTIGATIONS

BORINGS RECORDS

LABORATORY

None None None

HYDROLOGY & HYDRAULICS

SEEPAGE STUDIES

DAM STABILITY

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CONSTRUCTION, OPERATION . ENGINEERING DATA CHECK LIST DESIGN,

NAME OF DAM YMCA Pond Dam CT 00385 I.D. NO.

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POST-CONSTRUCTION SURVEYS OF DAM BORROW SOURCES

MONITORING SYSTEMS

MODIFICATIONS

HIGH POOL RECORDS

POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS

PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS

SPILLWAY PLAN

MAINTENANCE OPERATION RECORDS

DETAILS

SECTIONS

OPERATING EQUIPMENT PLANS & DETAILS

None available

REMARKS

Unknown

Unknown

New timber bridge over top of

dam

None

Unknown

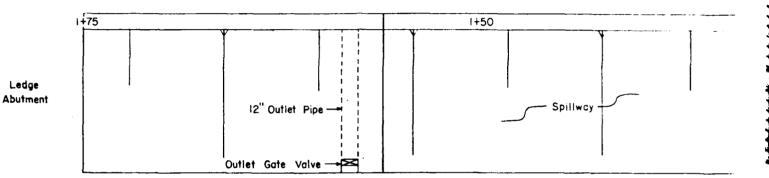
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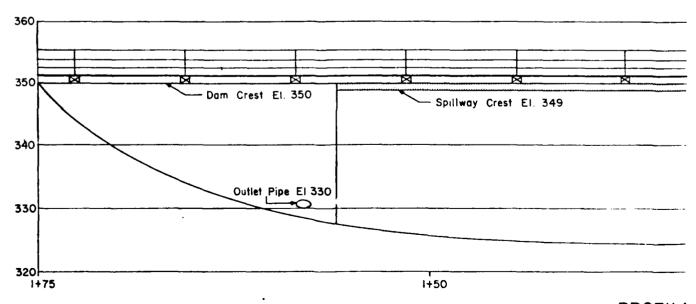
Field Measurements

Field Measurements

Not available

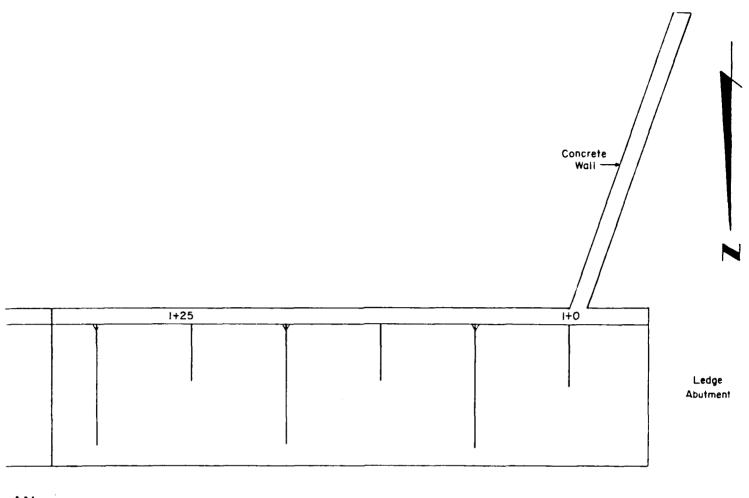


PLAN

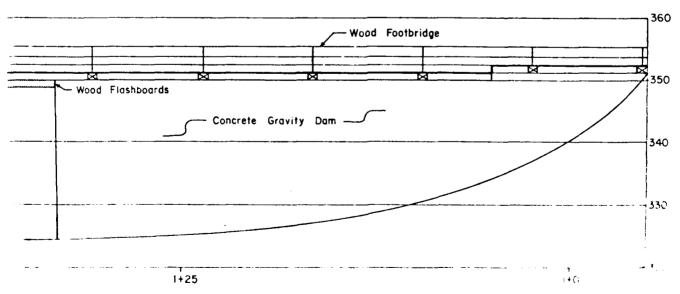


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YMCA POND DAY

Send your suggestion to: Employees' Suggestion Awards Program, 165 Capitol Ave., Hartford, 06115.

interdepartment Message

STO-201 REV. 3'77 STATE OF CONNECTICUT (Stock No. 6938-051-01)

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SAVE TIME: Handwritten messages are acceptable.

Use carbon if you really need a copy. If typewritten, ignore faint lines.

,	NAME		TITLE	DATE
To		Victor F. Galgowski	Supt. of Dam Maintenance	20 November 1978
, ,	AGENCY	Water Resources Unit	ADDRESS	
	NAME		TITLE	TELEPHONE
		Charles J. Pelletier	Consultant	
om	AGENCY		ADDRESS	
		Environmental Protection		
JECT		Farnam Neighborhood Camp Da	m, Durham (YMCA POND	DOM)

This structure was inspected on November 17, 1978.

The dam is a concrete gravity section about 20 feet high and 80 feet long. The structure spans a narrow rock gorge and appears to be founded on rock.

The entire length of the concrete dam can serve as spillway. There is a substantial wooden foot bridge on top of the dam which could adversely affect spillway capacity. However, a severe flood would probably overtop the walkway and wash it downstream without significant damage to the dam itself.

There is a substantial leak in the right abutment. The flow appears to be coming through interstices in the parent rock and is not detrimental to the structure safety. The leakage may make it difficult to retain a full pond during periods of low flow.

It is our opinion that the dam is Safe.

Water Resources Unit

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APPENDIX C

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PHOTOGRAPHS

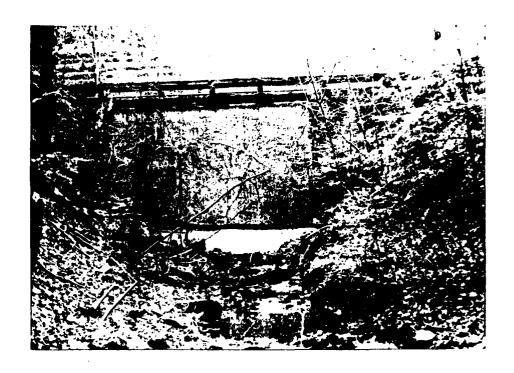


PHOTO #1: Downstream face of dam



PHOTO #2: Top of dam from left abutment



PHOTO #3: Upstream face of dam

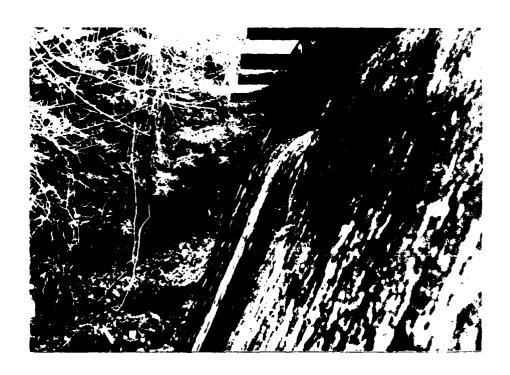


PHOTO #4: Downstream face looking toward right abutment

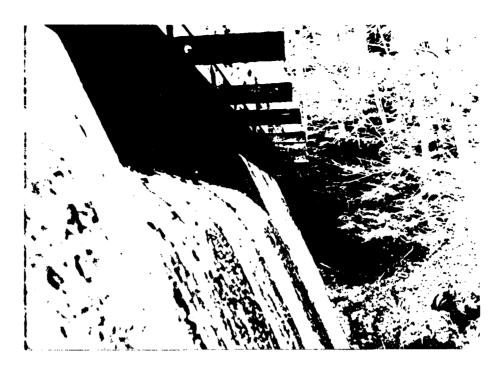


PHOTO #5: Downstream face looking toward left abutment



PHOTO #6: Right abutment



PHOTO #7: Left abutment



PHOTO #8: Downstream face from right abutment

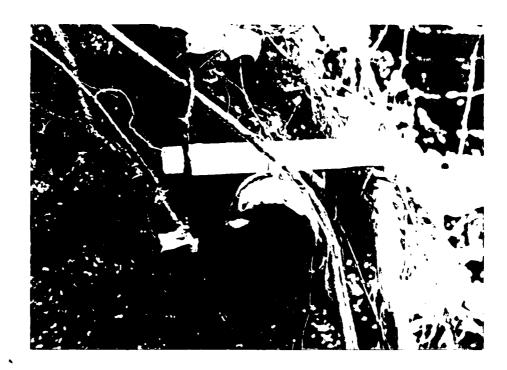


PHOTO #9: Location of 2 inch diameter metal pipe cast into concreted area of right abutment near seepage location



PHOTO #10: Blow-off valve at right abutment



PHOTO #11: Close-up of seepage from the rock in the right abutment



PHOTO #12: Downstream channel

APPENDIX D

HYDROLOGIC AND HYDRAULIC

COMPUTATIONS

PLAJECT 79-	90-10 PONDOUM
YMCA	MILCONOS
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FLAHERTY-GIAVARA ASSOCIATES SHEET NO._____ ENVIRONMENTAL DESIGN CONSULTANTS BY PAC DATE 4-17-80 ONE COLUMBUS PLAZA NEW HAVEN, CONN 06510/203/789-1260 CHK'D. BY DKS DATE 4-23-80

DETERMINATION OF SPILLWAY TEST FLOOD

Α.	SIZE	CLASSIF	ICATION

Storage Volume (Ac.-Ft.)

Height of Dam (Ft.)

Size Classification

SMALL

В. HAZARD POTENTIAL CLASSIFICATION

Category Loss of Life Economic Loss

Low None expected Minimal

Significant

<u>Few</u>

Appreciable

High

More than few

Excessive

Hazard Classification

SIGNIFICANT

HYDROLOGIC EVALUATION GUIDELINES

Hazard	<u>Size</u>	Spillway Test Flood
Low	Small Intermediate Large	50 to 100-Year Frequency 100-Year Frequency to 1/2 PMF 1/2 PMF to PMF
Significant	Small Intermediate Large	100-Year Frequency to 1/2 PMF 1/2 PMF to PMF PMF
High	Small Intermediate Large	1/2 PMF to PMF PMF PMF

Spillway Test Flood

100 YEAR FREDUENCY

^{*}Based upon "Recommended Guidelines for Safety Inspection of Dams" Department of the Army, Office of the Chief of Engineers, . November 1976.

PROJECT_	7990 10	>
LACA	POND	DAM
YURH	AM CON	N



FLAHERTY-GIAVARA ASSOCIATES SENVIRONMENTAL DESIGN CONSULTANTS

BY RAC DATE 4-16-5 CHK'D.BY DKC DATE 4-23-80

THE PMP RAINFALL IS 24 INCHES FOR A GHOUR DURATION STORM, USING A 20% FACTOR FOR IMPERFECT FIT THE EFFECTIVE RAINFALL IS 19.7.
INCHES, (FIG. 15, PAGE 48, DESIGN OF SMALL PAMS)

PMP I HOUR FIG 18, PG51

PMP 24 HOUR FIG 16, PG 49

KUNOFF

USING AN ASSUMED CN VALUE OF 80 FOR GLACIAL
TILL SULS, THE RUNOFFS IN INCHES FIRE:
(FIG A4, Pg 542, DESIGN OF SMALL DAMS)

I HOUR RAWFALL = 9.6 INCHES > RUNOFF = 7.1 INCHES

6 HOUR RAINFALL = 19.2 INCHES > RUNOFF = 16.5 INCHES

24 HOUR RAINFALL = 23.04 INCHES - RUNDEF = 20.0 INCHES

TIME OF CONCENTRATION

$$T_{c} = \frac{11.9 \, L^{3}}{14}$$

$$L = \frac{11.9 \, L^{3}}{1.3 \, Mi}$$

$$= \frac{11.9 \, (1.3)^{3}}{1.385}$$

PROJECT 79	19010)
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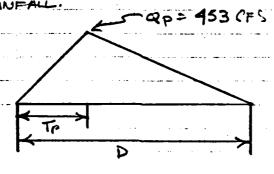
FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA NEW HAVEN CONN. GREGO203/280-1280

SHEET NO. 3 OF BY RAC DATE 17-9-50

1 HOUR

HUDROGRAPH

A TRIANGULAR HYDROGRAPH IS TO BE USED
FOR THE ROUTING OF THE TEST FLOOD THROUGH
THE RESERVOIR. PEAK FLOW EQUALS 453 CFS,
SET DURATION OF RUNOFF SO AS TO CONTAIN
YOLUME OF RUNOFF, AND RECEDING LIMB
EQUALS TWICE THE RISING LIMB FOR A 24 HOUR



YOLUME OF RUNOFFE = .25 (20" x .4 mi 2 = 107 AC-FT

PL-NEC HM	T 79 90 10 A POND DAM BRHAM CONA	

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FLAHERTY-GIAVARA ASSOCIATES ENVIRONMENTAL DESIGN CONSULTANTS

SHEET NO. 4 OF 7 BY MAC DATE 7-9-80 CHK'D, BY PB DATE 7-10-80

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TIME (HOURS)	INFLOW (CFS)
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	E=360	A = 4.6 ACRES		· · · · · · · · · · · · · · · · · · ·
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WITH.			Marine Service Comments	
-cv-su-conf		and the second s		
	. .I		ઝ	3 <i>5 </i>
			6 5	360
	2	8,3	60	350
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TOP HAM CONN	FLAHERTY ENVIRONME ONE COLUMBUS PI	NTAL DESIG	an consul	TANTS BY	RAC K.D.BY.DK	OF_7 DATE 4-17-9. S_DATE 4-23-80
STAGE D	15CHARGE	- DATA	N.T.			
				<u> </u>		
10,14	28	23	> 1	9'		
351		350	. .		١	•
		XXX	X			
WITH FUNSHBUARDS	The second secon					• • •
ELEVATION =	350	351	352	353	354	-
Q=3.3 (9) H1.5			30	84	154	
Qz=3,3(65) H1.5		214	606	1115	1716	
		-				
TOTAL CAPACITY	0	214	636	1199	1870.	
		9	-	**************************************		

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PROJECT_	1990	lo
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FLAHERTY-GIAVARA ASSOCIATES SHEET NO ._

ENVIRONMENTAL DESIGN CONSULTANTS BY RAC DATE 7-10-85 ONE COLUMBUS PLAZA, NEW HAVEN, CONN. 06510/203/769-1260 CHK'D. BY PR DATE 7-10-80

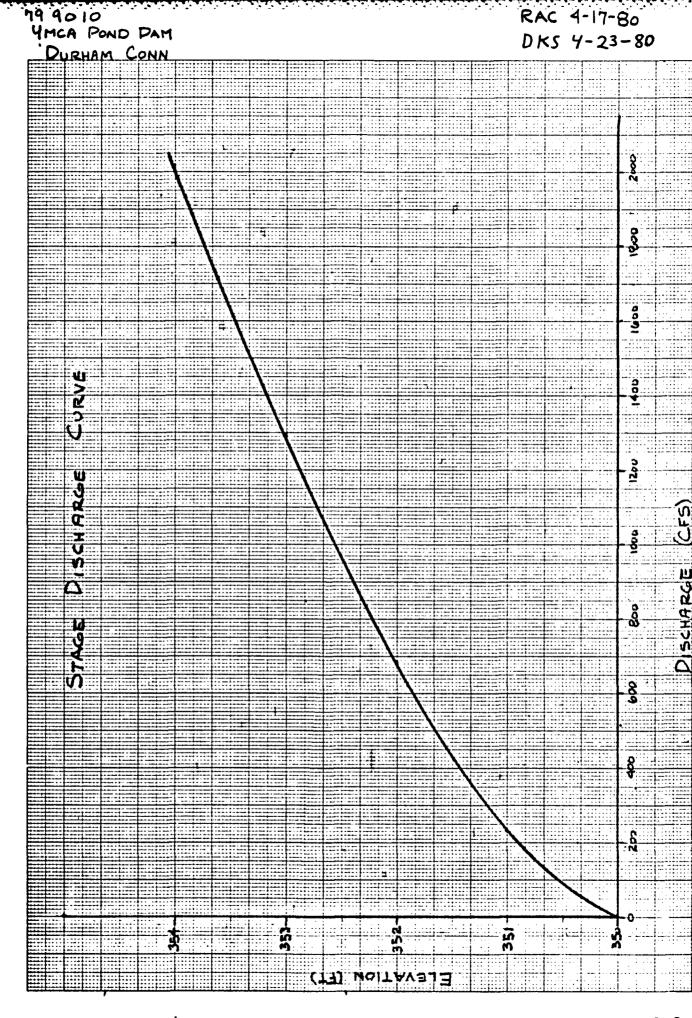
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NY KONFEL & ESSENCE MAKE USA NO. 25

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MAC REPFEL & ESSER CO. MAC 10 55.

THCA POND DAM	799010	FLOOD	FLOOD ROUTING		RAC	JULY	v 11, 1980 PG	
INPUT DATA: SEGMENT 1 SEGMENT 2 IE-350.0 IV-	UNSUBMERGED DISCHARGE CC DISCHARGE CC 0.0 E=350.	GED WEIR E COEFFICIENT E COEFFICIENT 350.0 A 3.60	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	LENGTH OF WEI LENGTH OF WEI 0 A= 4.60	IR = 9 IR = 65	313 313	VATION OF WEI VATION OF WEI	R = 351
HOUR	INFLOW	MASS INPLOW	WATER EL.	TAIL WATER	OUTFLOW	MASS OUTFLOW	STORAGE (R)	STORAGE (A)
00.0	OCF	-00 AC-	50.00F	.00F	OCF 55CF	.00A	0.00AC-F 2.94AC-F	OAC-
25.00	100	7.47AC-	51.60F	.00	2 CF	1.55AC-	.92AC-	.92A
000	40CF 26CF	0.24AC- 3.63AC-	51.39F	00 F	35CF	9.75AC-	.88AC-	.88AC-
000.0		107.64AC-F 112.31AC-F	350.72FT 350.22FT	0.00FT 0.00FT	133CFS 23CFS	99AC- 48AC-	.65AC-	2.64AC-F 0.83AC-F

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		WEIR WEIR WEIR	∼ ~~~~~~~
	1, 1980	10N OF 10N OF 10N OF 10N OF	STORAGE (R 0.00AC- 4.58AC- 7.48AC- 2.46AC- 2.46AC-
	JULY 11, CK PB	ELEVATI ELEVATI ELEVATI	
23.5	b v		OUTFLOW 0.00AC-F 0.79AC-F 0.90AC-F 0.33AC-F 0.84AC-F
		í	MASS 0 0. 28. 62. 87. 102.
2,04	RAC	127	OUTFLOW 115CFS 467CFS 351CFS 131CFS 131CFS 131CFS
		WEIR Weir Weir	
		LENGTH OF LENGTH OF LENGTH OF LENGTH OF	TAIL WATER .00FT 0.00FT 0.00FT 0.00FT 0.00FT
	FLOOD ROUTING	60 60 60 60 60 60 60 60 60 60 60 60 60 6	MATE 1 EL. 1 349.00FT 350.25FT 351.31FT 350.71FT 350.32FT 349.67FT
	000	IENT IENT IENT IENT 3.60	
		WEIR OEFFIC OEFFIC OEFFIC	MASS INFLOW 0.00AC-F 9.38AC-F 70.24AC-F 93.63AC-F 107.64AC-F 112.31AC-F
	799010	UNSUBMERGED DISCHARGE C DISCHARGE C DISCHARGE C DISCHARGE C	1NFLOW POCPS 227CPS 340CPS 226CPS 113CPS 10CPS
	. 3	A: 22 4 IV=	HOUR 1.00 2.00 5.00 6.00 6.00
	MCA POND DAM	INPUT DAT SEGMENT SEGMENT SEGMENT SEGMENT IE=349.0	

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FGA FLOOD WAVE ROUTING

APPROXIMATE FLOOD WAVE ROUTING BASED UPON U.S. ARMY CORPS OF ENGINEERS: "RULE OF THUMB GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS" DATED APRIL, 1978.

INITIAL STATION = 0 +0
INITIAL BASE FLOW = 281 CFS
INITIAL WAVE HEIGTH = 26.0 FT
ASSUMED BREACH WIDTH = 82.0 FT
INITIAL RESERVOIR STORAGE = 24 ACRE-FT
COMPUTED FLOOD WAVE FEAK FLOW = 7,128 CFS
TOTAL FLOOD WAVE PEAK FLOW = 7,859CFS

STATION 0470

OFFSFT	ELEV.	OFF:SE	r ELEV	<i>)</i> (OFFSET	ELEV.
-370.0 FT	400.0 FT		= 0,080 = 0,080)	בו ה גייני	350.0 FT
	340.0 FT					330.0 FT
		N =	= 0.040			
	323.0 FT 323.0 FT	-5.0 }	m 320.0	FT	5.0 FT	320.0 FT
		N :	= 0,080			
10.0 FT	323.0 FT			S FIT THE	o o em	ACCO O ETT
	450.0 FT		, 33010	, , ,	.0.0	400.011
AREA	WETTED	PERIMETER	N	VELO	CITY	FLOW
45.4						
21.5 SF			0.08			217CFS
154.8 SF		Le fy	0.04			€, 750CFS
· 27.9 SF	1.	1.5 FT	0.08	3O 10.5	5 FPS	295CFS
INVERT	DEPTH W	SURFACE	ARFA	VELOCITY	FLO	W SLOPE
320.0 FT	8.4 FT	328.4 FT	204 SF	35.5 FPS	7,263	CFS 0.1000
BASE FLOW =	231 CF3	BASE S	STAGE =	321.4 FT.		

STATION 5 +0

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SOFFEET	ELEV.	OFFSE	T ELEV	ν. α	FTSET	ELEV.	
N = 0.080 -\$10.0 FT 360.0 FT -410.0 FT 350.0 FT -100.0 FT 330.0 FT							
-310.0 FT	360.0 FT	-410.0	FT 350.0) 17 - 10	O.O FT	330.0 FT	
\$20.0 FT	310.0 FT	-10.0	FT 308.0) F.L.			
W.		N	= 0.040				
₹10.0 FT	BOS.O FT	-5.0	FT 305.0	FT	5.0 FT	305.0 FT	
10.0 FT	BOS.O FT						
10.0 FT 420.0 FT		N	= 0.080				
₹ 10.0 FT	308.0 FT	30.0	FT 310.0)	0.0 FT	340.0 FT	
420.0 FT	350.0 FT	630.0	FT 360.0) FIT			
Č							
AREA	WETTED	PERIMETER	N	VELO	CITY	FLOW	
% 82.0 SF 165.0 SF	,	I	/\ /\	30 7.3	i merce	COBCES	
A SELU SE	E	6.7 FT		40 26.9			
105.0 55		1.6 FT		30 8.4		1,047CFS	
,124.0 SF	ت	2.7 FT	0.00	30 6.4	rra	1,041015	
INVERT	DEPTH W	. SURFACE	AREA	VELOCITY	FLOV	V SLOPE	
S.O FT	9.0 FT	314.0 FT	371 SF	16.4 FPS	6,093	CFS 0.0350	
	221 75	C) PLACE	CHACK =	BOS 9 FT.			

STATION 8 +0

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OFFSET	ELEV.	OFFSET	ELEV.	OFFSET	ELEV.		
OFF SE		N = (). OEO				
-150.0 FT	310.0 FT	-50.0 FT		-10.0 FT	BOO.O FT		
N = 0.040							
-10.0 FT	300.0 FT		297.0 FT	5.0 FT	297.0 FT		
-10.0 FT 10.0 FT	300.0 FT						
N = 0.080							
10.0 FT	300.0 FT	200.0 FT		•			
AREA	WETTED F	PERIMETER	N	VELOCITY	FLOW		
				V 6	1 1.014		
≨247.1 SF	81.	O FT	0.050	10.2 FPS	2,536CFS		
126.7 SF		6 FT	0.040	19.8 FPS	2,512CFS		
126.7 SF 52.9 SF	26.	2 FT	0.080	4.8 FPS	258CFS		
INVERT	DEPTH W.	SURFACE A	REA VELO	OCITY FLO	W SLOPE		
all of	7.0 FT 30	94.0 FT 4	26 SF 12.4	F FPS 5, 307	CFS 0.0270		
ANT FLOW =	231 CFS	BASE STA	GE = 299.0	O FT.			

STATION

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	OFFSET			· ELEV.	OFFSET	ELEV.
	-1120.0 FT -30.0 FT	310.0 FT		0.050 300.0 FT 279.0 FT	-470.0 FT	290.0 FT
	-10.0 FT	79.0 FT 279.0 FT	N = -5.0 FT	0.040 276.0 FT	5.0 FT	276.0 FT
3	10.0 FT 380.0 FT	279.0 FT 300.0 FT	N = 20.0 FT 580.0 FT	0.080 71 0.085 71 0.088	BOO.O FT	290.0 FT
3 (3	S AREA	WETTED	PERIMETER	N	VELOCITY	FLOW
	102.8 SF	21	.7 FT .6 FT .7 FT	0.050 0.040 0.080	7.0 FFS 20.6 FFS 4.2 FPS	1,2240FS 2,3000FS 4420FS
	INVERT	DEPTH W.	SURFACE	AREA VELO	OCTTY FLO	W SLOPE
(,	276.0 FT	6.3 FT 2	82.3 FT	387 SF 10.2	2 FPS 3,960	CFS 0.0350
$\langle \zeta \rangle$	BASE FLOW =	231 CFS	BASE ST	AGE = 277.9) FT.	
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		OFFSET	ELEV.	OFFSFT	ELEV).	OF	FFSET	ELE	V.
330 - 6		-530.0 FT -10.0 FT	300.0 FT 246.0 FT		0.050 T 260.0) "]"	-100)O FT	250.0	o FT
13/13/13			246.0 FT 246.0 FT		0.040 T 243.0	T''I (Ë	5.0 FT	243.(O FTT
3375		10.0 FT 1000.0 FT	246.0 FT 260.0 FT	20.0 F	0.080 T 250.0 T 270.0) FT) FT	50 1760). O FT). O FT	260.0 300.0	
223	C.S.	AREA	WETTED	PERIMETER	N		VELO	YTE	Fi	LÜM
155.35		109.7 SF 107.4 SF 12.1 SF	21	.3 FT .6 FT .4 FT	0.05 0.04 0.08	ιO	6.1 16.7 3.6	FFS	1,798	9CFS BCFS 4CFS
33	Ď	INVERT	DEPTH W.	SURFACE	AREA	VELO	CITY	FLO	W	SLOPE
	(, , ,	243.0 FT	6.1 FT 2	49.1 FT	229 SF	11.0	FFS	2,573	CFS	0.0240
	(BASE FLOW =	231 CFS	BASE S	TAGE =	245.1	FT.			
33	(<u>;</u>									
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22.21 M. 15.55	吕									
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12.7			ر مار پر منسور							
7	Ì			rar ker	`v.E -≛`` <u>b</u> ⊾8	<u> </u>	O			
		OFTSET	ELEV.	OFFSET	. ELEV	<i>)</i>	· (1)	-rsét	ELE	V.
	133		·		. 0.080					
		-450.0 FT	300.0 FT	-190.0 F	T 270.0) FT	-100	O.O FT	250.	o fit
- 7	CX	-70.0 FT	240.0 FT) 1.1				
22		~10.0 FT	221.0 FT	N = -5.0 F	0.040 T 218.0) F-T	ι	s.o er	248	O FT
BYSEN		10.0 FT	221.0 FT				•			
*		4 /2 /2 p	*******	N =	0.080					
E. 5.4.		950.0 FT	221.0 FT 250.0 FT	100°0 F	1 EEO.C) 11.	230	0. O 17T	260.	O FT
	C_{2} .									
	-	AREA	WETTED	PERIMETER	N		VELO	YTT	177	LOW
1	(19.6 SF		.6 FT	0.08			FFS		4CFS
3.33	1	115.5 SF 19.3 SF		.6 FT .5 FT	0.04 0.08		16.4 3.8	FPS FPS		9CFS 3CFS
					,					
MATHER SESSIONS		INVERT	DEPTH W.	SURFACE	AREA	VELO	CITY	FLO	M	SLOPE
12	<i>(</i> ,	218.0 FT	6.5 FT 2	24.5 FT	154 SF	13.2	FPS	2,047	CFS	0.0210
	(³ E	BASE FLOW =	231 CFS	BASEL S	TAGE =	220.2	FT.			•
(2)	r									
	(3)									
252										
327	(,••,									
76	C.			·						
ARRESTOR SIGNATURE	C.									
7.7										
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1	• •									
22										
22.2										
7		•								
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2	202		<u> </u>			\$ 550.55				

STATION 50 +0

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•	OFFSET	ELEV.	OFFSE	ET ELES	<i>)</i>	OFFSET	ELEV.
	-350.0 FT -10.0 FT			= 0.050 FT 220.0	T'' C	250.0 FT	210.0 FT
••			N	= 0.040			
	-10.0 FT 10.0 FT		-5.0) FT	5.0 FT	202.0 FT
			N	= 0.050			
1.50		205.0 FT 230.0 FT	25.0			175.0 FT	220.0 FT
Ţ,	AREA	WETTED	PERIMETER	R N	VEI	LOCITY	FLOW
	117.1 SF	10	6.0 FT	0.0!	50 4	O FPS	470CFS
•	89.1 SF		1.6 FT				1,076078
	7.3 SF		6.9 FT	O. 05	50 3	.8 FPS	28CFS
Ū	INVERT	DEPTH W	. SURFACE	AREA	VELOCIT	Y FLO	W SLOPE
	202.0 FT	5.2 FT	207.2 FT	213 SF	7.3 FT	8 1,575	CFS 0.0160
	RACE FIRM =	221 05	C BACE	CTACH =	POA A ETT		

	. 40.4					Minteriorisaininis	in in it is a constant in the
	<u>:</u>						
7777							
			S	TATE ON	i se .	· 😊	
	353	OFTSET	ELEV.	1		OPPSET	ELEV.
3330 - 35E		-1150.0 FT -10.0 FT	230.0 FT	N =	0.050 210.0 FT	-100.0 FT	200.0 FT
77.77	`* ('};	-10.0 FT	200.0 FT 200.0 FT		0.040 197.0 FT	5.0 FT	197.0 FT
7. SS.	ESS.	10.0 FT 1050.0 FT	200.0 FT 230.0 FT		0.050 210.0 FT	800.0 FT	210.0 FT
GAKK	15.5	AREA	WETTED	PERIMETER	N	VELOCITY	FLOW
200200		242.3 SF 75.5 SF 4.6 SF	21	.4 FT .6 FT .2 FT		2.7 FPS 7.6 FPS 2.1 FPS	672079 5770F9 100FS
20		INVERT	DEPTH W.	SURFACE	AREA VELC	OCITY FLO	W SLOPE
	(_. ्रे	197.0 FT	4.5 FT 2	01.5 FT	322 SF 3.9	FPS 1,259	CFS 0.0080
	(E	BASE FLOW =	231 CFS				
22 02	(3r						•
***************************************	(3) (3)						
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ASSISTANCE CONTRACTOR OF THE SECOND S	3						
24. J. 22	187						
	W.A.			DECEMBER OF			

STATION 58+50

		OFFISHT	ELEV.	OFFSET	. ELEV.	OFFSET	ELEV.
	18 P. S.	-1150.0 FT -10.0 FT	220.0 FT		0.050 T 210.0 FT	-350.0 FT	200.0 FT
		-10.0 FT 10.0 FT			: 0.040 T 195.0 FT	5.0 FT	195.0 FT
	1	10.0 FT 1900.0 FT		N = 500.0 F	: 0.050 TT 200.0 FT	1500.0 Fĭ	200.0 FT
	1.00 M	AREA	WETTED	PERIMETER	N	VELOCITY	FLOW
		131.8 SF 69.9 SF 190.0 SF	21	.7 FT .6 FT .1 FT		1.9 FPS 7.2 FPS 1.9 FPS	507CFS
	Ľ	INVERT	DEPTH W.	SURFACE	AREA VELO	CITY FLO	W SLOPE
	į.	195.0 FT	4.2 FT 1	99.2 FT	391 SF 2.8	: FPS 1,131	CFS 0.0080
(E	BASE FLOW =	231 CFS	BASE S	7AGE = 197.9	FT.	
\$5 \$5	7						
	7.67				•		
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22.22	\$0 \$						
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	X 30					ૹૻૺઌૼૺ૱૽ૹ૽૽૱૽૽૱૽૽૱૱૽ૺ૱૽ૺૺૺૺૺૺૺૺૺૺૺૺૺૺૺૺૺૺૺૺૺ	

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	OFFSET	ELEV.		OFFSE	.γ	ELEV.		OFFS	ET	ELI	iv.
	-2000.0 FT -1400.0 FT	230.0 F	77) 77)	-1800.0	E.T.	.050 220.0 F 196.0 F	T -1	600.0	i kut	210.	.o r
200 B	-10.0 FT 10.0 FT	190.0 F				.040 193.0 F	'I '	5.0	FT	193.	O FT
· 👰	10.0 FT 4400.0 FT	196.0 F 200.0 F		N 1400.0 4700.0	FΥ	.050 200.0 F 210.0 F		:000.0 :200.0			O FT
£	AREA	WETT	TD F	PERIMETER		N	VE	LOCIT	Y	(-	LOW
	186.7 SF 65.7 SF 186.7 SF		21.	3 FT 6 FT 3 FT		0.050 0.040 0.050	€	.4 FP9	ຮ	39	7CFS SCFS 7CFS
(F)	INVERT	DEPTH	w.	SURFACE	AF	KEIA VI	ELOCIT	Y	FLO	W	SLOPE
	193.0 FT	4.0 FT	19	87.0 FT	4:	89 SF 7	2.1 FF	ទ	951	CFS	0.0060
	BASE FLOW =	231	CF'S	DASE	STAG	BE = 190	5.1 FT				
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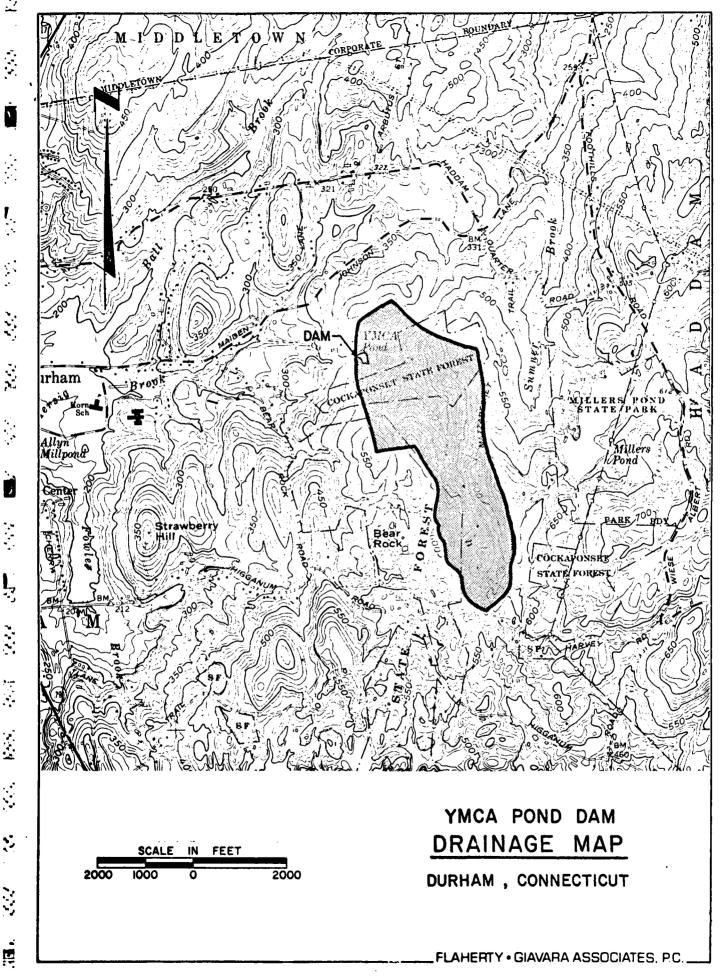
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OFFSET	ELEV.	OFFSET	· ELEV	<i>).</i> (OFFSET	ELEV.	•
		, N =	0.050				
-1350.0 FT	240.0 FT	-1200.0 F	T 230.0) FT 110	DOLO FT	220.0	FT
-300.0 FT	200.0 FT	-100.0 F	T 190.0) ITT — 1	O.O FT	186.0	FT
		N =	0.040				
-10.0 FT	186.0 FT	-5.0 F	T 183.0) FT	5.0 FT	183.0	FΥ
10.0 FT	186.0 FT						
		N =	0.050	•			٠
10.0 FT	186.0 FT	350.0 F	T 190.0) FT 140	00.0 FT	200.0	F.J.
1800.0 FT	210.0 FT	2300.0 F	7 220.0) FT 249	SOLO FT	230.0	F"1"
AREA	WE TITTO	PERIMETER	N	Ulfa f	CITY	FLO	*H14
· · · · · · · · · · · · · · · · · · ·	***************************************	F South Call F Stone F South C		V	,0111	I had	~1/V
21.0 SF	3	0.8 FT	0.05	0 1.9	FPS	400	JFS .
72.3 SF	2	1.6 FT	0.04	0 6.9	FFS	5020	
79.5 SF	11	5.2 FT	0.05	0 1.9) FPS	1530)FS
INVERT	DEPTH W	. SURFACE	ADETA	1 HTT 1925 Y 1957	6***		#*** #********
TIAACL/ I	DEFIN W	. DURT MUL	AREA	VELOCITY	FLO	₩	SLOPE
183.0 FT	4.3 FT	187.3 FT	172 SF	4.0 FPS	696	CFS C	0.0070
BASE FLOW =	231 CF9	B PLASE ST	TAGE =	186. O FT			

	OFFSET	ELEV.		r · ELEV	. 0	FFSET	ELEV.	
•		,	N =	0.050				
7		220.0 FT 179.0 FT	-300.0 F	T 210.0	FT -10	0.0 FT	180.0	F- T
.•	1010 / /			45 E3 4 45				
Le				· 0.040			/	
7	-10.0 FT	179.0 FT	-5.0 F	TT 176.0	TT	5.0 FT	1760	17·T
. '	10.0 FT	179.0 FT						
Ē,			N =	= 0.050				
	10.0 FT	179.0 FT	450.0 F	T 180.0	FT 1050	0.0 FT	190.0	FT
		200.0 FT						
_	ILOO10 I I	LOUID	100010 /					
,								
ŧ	AREA	1.00 3 3 3 5 7	PERIMETER	N	VELO	~~~~	rLO	Hal
	AREM	WEITEL	LEW THE LEW	. 14	V \$\$()	U111	, 20	***
,	23.3 SF	64	7 FT	0.05	0 1.3	FPS	31C	FS
,	59.3 SF	21	.6 FT	0.04	0 6.5	FPS	3860	FS
	113.9 SF		. 7 FT	0.05		FPS	1530	
•	11212 ()		• • • •	0.02				· -
Ì								
í	INVERT	DEPTH W.	SURFACE	ARFA	VELOCITY	FLO	N	SLOPE
	7144 (-17.)	CE, III W.	CENT TICE	7 67 51:	722001.,		•	
•	176.0 FT	3.7 FT 1	79.7 FT	196 SF	2.9 FPS	571	CFS 0	0300
•								
	BASE FLOW =	231 CFS	BASE 9	STAGL =	178.9 FT.			

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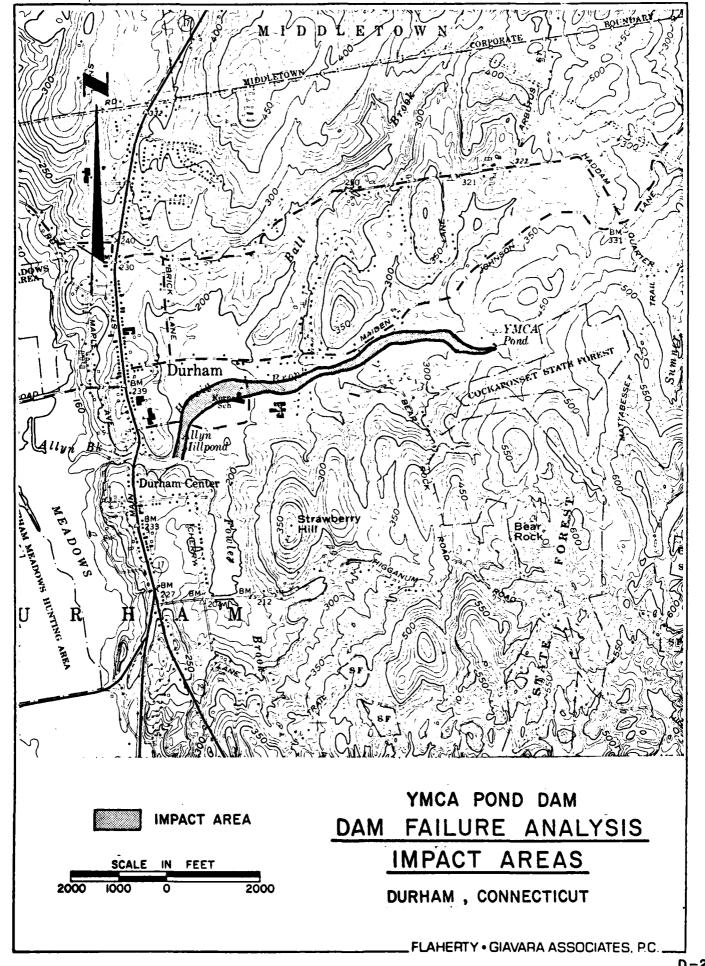
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APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

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THESTG BECODA	1 1	•		POND		②	•	
1	RECHUN BASIN			NEAREST DOW CITY - TOWN	NSTREAM -VILLAGE	FROM DAM (ML.)	POPULATION	
101 22 101 22 101 23 101 24 101 25 101 25 101 25 101 25 101 25 101 25 24 24 24 24 24 24 24		4009a	\vdash				5200	
1911 REMARKS REGULATORY AGENCY REPETTY GIAVARA ASSOCIATES CONDATE REMARKS	- EI F		STANCE PERSON PE		$\Gamma\Gamma$		FED	PRV/FED
POWER CAPACITY SPILLWAY	FUCI.		4 3			. (z	z
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SPILLWAY SPI	> F. ESTIMATE.	ESITÄTE		(#)	(E)	(E)	9	
CONSTRUCT CONSTRUCTION BY CONSTRUCT CAMADRA ASSOCIATES CAMADRA	HAS LENGTY TYPE	MAXIMUM DISCHANGE (FT.)			STENETH WILLIAMS	NAVIGATION	LOCKS LOCK WIDTHLEN	PLE WIDTH
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SIGN SIGN CONSTRUCTION INSPECTION BY CLOUDY 79 CLO	5	WNER	ENGINE	ERING BY	CONSTR	UCTION BY		
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SIGN CONSTRUCTION CONTRUCTION	•		REGULAT					-
GIAVARA ASSOCIATES (**) CONN DEP (**) (**) CONN DEP (**) (**) (**) REMARKS	DESIG		VSTRUCTION	1 1	ION	MAINTENA	NCE	
GIAYARA ASSOCIATES REMARKS				2		NN DEP		
GIAYARA ASSOCIATES CALON79 P.L. 92-	COMP DEP -	+		3	9			
GIAVARA ASSOCIATES (9) CO-100779 P.L.		INSPECTION BY	INSP	ECTION DATE	AUTHORITY FOF	INSPECTION		
REMARKS					92=367			
			REMAR	IKS				

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